

**WHAT IS CLAIMED IS:**

1           1. A flexible medium transport simulation apparatus  
2    which simulates transport of a sheet-like flexible medium  
3    in a transport mechanism and three-dimensionally  
4    displays the simulated transport, the apparatus  
5    comprising:

6           a flexible medium setting section for setting the  
7    length and the width of said flexible medium as  
8    dimensional information, the length being a measurement  
9    in a transport direction in which the flexible medium  
10   is transported and the width being a measurement in a  
11   widthwise direction which is perpendicular to the  
12   transport direction with respect to a plane on which said  
13   flexible medium is transported;

14          a transport path setting section for setting a  
15   three-dimensional transport path covering a widthwise  
16   deviation of said flexible medium, along which path said  
17   flexible medium is transported in said transport  
18   mechanism;

19          a travel amount information input section for  
20   inputting travel amount information about an amount of  
21   travel of said flexible medium;

22          a simulation section for simulating the transport  
23   of said flexible medium carried out by said transport  
24   mechanism, by using a three-dimensional mechanism model

25 of said transport mechanism being constructed inside said  
26 simulation section;

27 a display for displaying the transport of said  
28 flexible medium; and

29 a display control section for controlling said  
30 display so as to display a result of the simulation  
31 performed by said simulation section,

32 said simulation section comprising:

33 a position/posture computation section which  
34 computes a three-dimensional transport position of said  
35 flexible medium along the three-dimensional transport  
36 path, and also computes a two-dimensional posture of said  
37 flexible medium in a plane orthogonal to the widthwise  
38 direction, on the basis of the dimensional information,  
39 which is set by said flexible medium setting section,  
40 of the three-dimensional transport path, which is set  
41 by said transport path setting section, and of the travel  
42 amount information, which is input by said travel amount  
43 information input section; and

44 a three-dimensional image preparation  
45 section which prepares a three-dimensional image of said  
46 flexible medium on the basis of the three-dimensional  
47 transport position or the two-dimensional posture, which  
48 is computed by said position/posture computation section,  
49 and of the dimensional information, which is set by said  
50 flexible medium setting section, and outputs the

51 three-dimensional image as the result of the simulation.

1 2. A flexible medium transport simulation apparatus  
2 according to claim 1, wherein

3 said travel amount information input section is  
4 a pointing device adapted to be operated by a user, and  
5 wherein

6 a three-dimensional image of said flexible medium  
7 appearing on said display is operated by use of said  
8 pointing device, with the result that the amount of  
9 operation of the three-dimensional image is input to said  
10 simulation section as the travel amount information.

1 3. A flexible medium transport simulation apparatus  
2 according to claim 1, wherein

3 said travel amount information input section is  
4 a pointing device adapted to be operated by a user, and  
5 wherein

6 an image, appearing on said display, of a component  
7 of said transport mechanism, which component acts on said  
8 flexible medium, is operated by use of said pointing  
9 device, with the result that the amount of operation of  
10 the component image is input to said simulation section  
11 as the travel amount information.

1 4. A flexible medium transport simulation according

2 to claim 1, wherein  
3 said travel amount information input section is  
4 a control program execution section which executes a  
5 control program for controlling the operation of said  
6 transport mechanism and computes an amount of control  
7 of a component of said transport mechanism, which  
8 component acts on said flexible medium, and wherein  
9 the amount of control computed by said control  
10 program execution section is input to said simulation  
11 section as the travel amount information.

1 5. A flexible medium transport simulation apparatus  
2 according to claim 3, further comprising a travel ratio  
3 setting section which sets a travel ratio; i.e., a ratio  
4 of a travel amount of said flexible medium to a rotation  
5 amount of a roller, in a case where said transport  
6 mechanism includes a roller which comes into contact with  
7 and acts on said flexible medium, and wherein said  
8 simulation section simulates transport of said flexible  
9 medium on the basis of the travel ratio set by said travel  
10 ratio setting section.

1 6. A flexible medium transport simulation apparatus  
2 according to claim 4, further comprising a travel ratio  
3 setting section which sets a travel ratio; i.e., a ratio  
4 of a travel amount of said flexible medium to a rotation

5 amount of a roller, in a case where said transport  
6 mechanism includes a roller which comes into contact with  
7 and acts on said flexible medium, and wherein said  
8 simulation section simulates transport of said flexible  
9 medium on the basis of the travel ratio set by said travel  
10 ratio setting section.

1 7. A flexible medium transport simulation apparatus  
2 according to claim 5, wherein said travel ratio setting  
3 section randomly sets the travel ratio in accordance with  
4 a predetermined statistical distribution.

1 8. A flexible medium transport simulation apparatus  
2 according to claim 6, wherein said travel ratio setting  
3 section randomly sets the travel ratio in accordance with  
4 a predetermined statistical distribution.

1 9. A flexible medium transport simulation apparatus  
2 according to claim 1, wherein said simulation section  
3 handles said flexible medium as a three-dimensional model,  
4 the model being constituted by means of interconnecting  
5 a plurality of strip-shaped members so as to be rotatable  
6 about an axis parallel to said widthwise direction.

1 10. A flexible medium transport simulation  
2 apparatus according to claim 1, wherein said transport

3 path setting section sets the three-dimensional  
4 transport path through use of circular arcs and straight  
5 lines.

1 11. A flexible medium transport simulation  
2 apparatus according to claim 1, wherein said  
3 position/posture computation section approximately  
4 computes the two-dimensional posture through use of  
5 circular arcs and straight lines.

1 12. A flexible medium transport simulation  
2 apparatus according to claim 1, wherein said travel amount  
3 information input section inputs the travel amount  
4 information while a position of a load center of the force  
5 applied for putting said flexible medium in motion is  
6 made stationary on said flexible medium, and said  
7 position/posture computation section computes the  
8 two-dimensional posture based on the last-named travel  
9 amount information and on the position of the load center  
10 on said flexible medium.

1 13. A flexible medium transport simulation  
2 apparatus according to claim 12, wherein, in a case where  
3 said flexible medium is a notebook-shaped medium  
4 consisting of a plurality of leaves, the position of the  
5 load center is limited on an externally-exposed leaf of

6 said notebook-shaped medium.

1           14. A flexible medium transport simulation  
2 apparatus according to claim 1, wherein said travel amount  
3 information input section inputs the travel amount  
4 information such that a position of a load center of the  
5 force applied for putting said flexible medium in motion  
6 is shifted on said flexible medium, and said  
7 position/posture computation section computes the  
8 two-dimensional posture based on the last-named travel  
9 amount information while the position of the load center  
10 on the flexible medium is perceived.

1           15. A flexible medium transport simulation  
2 apparatus according to claim 13, wherein, in a case where  
3 said flexible medium is a notebook-shaped medium  
4 consisting of a plurality of leaves, page numbers are  
5 assigned to respective leaves, and said position/posture  
6 computation section perceives a leaf, on which the load  
7 center is located, on the basis of the page number and  
8 further perceives the position of the load center on the  
9 leaf.

1           16. A flexible medium transport simulation  
2 apparatus according to claim 1, wherein said  
3 position/posture computation section computes the

4 three-dimensional transport position, through use of a  
5 value which is obtained by adding a predetermined error  
6 amount to the length of a predetermined portion of the  
7 three-dimensional transport path, which is set by the  
8 transport path setting section, to simulate deviation  
9 of said flexible medium being transported through the  
10 predetermined portion.

1 17. A flexible medium transport simulation  
2 apparatus according to claim 16, further comprising an  
3 error amount setting section for randomly setting the  
4 predetermined error amount in accordance with a  
5 predetermined statistical distribution.

1 18. A flexible medium transport simulation  
2 apparatus according to claim 1, wherein, when said  
3 flexible medium arrives at a predetermined position, said  
4 position/posture computation section fixes the  
5 three-dimensional transport position to the  
6 predetermined position or computes the  
7 three-dimensional transport position such that a  
8 transport speed of said flexible medium is decreased,  
9 to simulate the occurrence of troubles in transport of  
10 said flexible medium at the predetermined position.

1 19. A flexible medium transport simulation



2 apparatus according to claim 18, further comprising a  
3 position setting section which randomly sets said  
4 predetermined position in accordance with a  
5 predetermined statistical distribution.

1        20. A flexible medium transport simulation  
2 apparatus according to claim 1, wherein said flexible  
3 medium setting section further sets the thickness of said  
4 flexible medium as the dimensional information about said  
5 flexible medium, and said simulation section simulates  
6 transport of said flexible medium in consideration of  
7 the thickness set by said flexible medium setting section.

1        21. A method of simulating transport of a sheet-like  
2 flexible medium in a transport mechanism and  
3 three-dimensionally displaying the simulated transport,  
4 the method comprising:

5        a flexible medium setting step for setting the  
6 length and the width of said flexible medium as  
7 dimensional information, the length being a measurement  
8 in a transport direction in which the flexible medium  
9 is transported and the width being a measurement in a  
10 widthwise direction which is perpendicular to the  
11 transport direction with respect to a plane on which said  
12 flexible medium is transported;

13        a transport path setting step for setting a

14 three-dimensional transport path covering a widthwise  
15 deviation of said flexible medium, along which path said  
16 flexible medium is transported in said transport  
17 mechanism;

18 a travel amount information input step for  
19 inputting travel amount information about an amount of  
20 travel of said flexible medium;

21 a simulation step for simulating the transport of  
22 said flexible medium carried out by said transport  
23 mechanism, with use of a three-dimensional mechanism  
24 model of said transport mechanism; and

25 a display step for displaying the transport of said  
26 flexible medium, simulated in said simulation step, on  
27 a display,

28 said simulation step includes:

29 a position/posture computation step for  
30 computing a three-dimensional transport position of said  
31 flexible medium along the three-dimensional transport  
32 path, and also computes a two-dimensional posture of said  
33 flexible medium in a plane orthogonal to the widthwise  
34 direction, on the basis of the dimensional information,  
35 which is set in said flexible medium setting step, of  
36 the three-dimensional transport path, which is set in  
37 said transport path setting step, and of the travel amount  
38 information, which is input in said travel amount  
39 information input step; and

40                   a three-dimensional image preparation step  
41   for preparing a three-dimensional image of said flexible  
42   medium on the basis of the three-dimensional transport  
43   position or the two-dimensional posture, which is  
44   computed in said position/posture computation step, and  
45   of the dimensional information, which is set in said  
46   flexible medium setting step, and outputting the  
47   three-dimensional image as the result of the simulation.

1           22. A computer-readable recording medium which  
2   stores a flexible medium transport simulation program  
3   for instructing a computer to execute functions of  
4   simulating transport of a sheet-like flexible medium in  
5   a transport mechanism and of three-dimensionally  
6   displaying the simulated transport, wherein  
7           said flexible medium transport simulation program  
8   instructs the computer to function as:  
9           a transport path setting section for setting  
10   a three-dimensional transport path covering a widthwise  
11   deviation of said flexible medium, along which path said  
12   flexible medium is transported in said transport  
13   mechanism;  
14           a travel amount information input section for  
15   inputting travel amount information about an amount of  
16   travel, starting from a predetermined position, of said  
17   flexible medium;

18                   a simulation section for simulating the  
19 transport of said flexible medium carried out by said  
20 transport mechanism, by using a three-dimensional  
21 mechanism model of said transport mechanism being  
22 constructed inside said simulation section; and  
23                   a display control section for controlling a  
24 display so as to display a result of the simulation  
25 performed by said simulation section,  
26                   the computer, when it functions as the simulation  
27 section, being instructed to function as:  
28                   a position/posture computation section which  
29 computes a three-dimensional transport position of said  
30 flexible medium along the three-dimensional transport  
31 path, and also computes a two-dimensional posture of said  
32 flexible medium in a plane orthogonal to the widthwise  
33 direction, on the basis of dimensional information set  
34 in advance, of the three-dimensional transport path,  
35 which is set by said transport path setting section, and  
36 of the travel amount information, which is input by said  
37 travel amount information input section; and  
38                   a three-dimensional image preparation  
39 section which prepares a three-dimensional image of said  
40 flexible medium on the basis of the three-dimensional  
41 transport position or the two-dimensional posture, which  
42 is computed by said position/posture computation section,  
43 and of the dimensional information, and outputs the

44 three-dimensional image as the result of the simulation.

115